

Amendments to the Claims:

A clean version of the entire set of pending claims, including amendments to the claims, is submitted herewith per 37 CFR 1.121(c)(3). This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) [[A]] In a computer system including a processor, a storage device, and a user interface, a method for determining RGB filter set and color estimation performance for RGB LED color sensing, the method comprising:
the computer system receiving, via the user interface, a user selection of an RGB filter set;
the processor retrieving from a database in the storage device data describing a spectral response for the selected RGB filter set;
the processor constructing a criteria function describing an error between desired color matching functions and [[a]] the spectral response of [[an]] the selected RGB filter set;
the processor determining RGB filter set response characteristics for the selected RGB filter set based on the criteria function; and
the processor determining color estimation parameters for substantially optimal color estimation with the selected RGB filter set based upon the determined RGB filter set response characteristics for the selected RGB filter set.

2. (Currently Amended) The method of claim 1 wherein determining the RGB filter-response characteristics for the selected RGB filter set comprises evaluating the criteria function to determine the RGB filter-response characteristics for the selected RGB filter set resulting in a minimum value of a constraint set criteria function.

3. (Currently Amended) The method of claim 2 wherein the criteria function is represented by the equation:

$$J_{M,n} = \int_{\sigma} \begin{bmatrix} R_{LED}(\lambda) & 0 & 0 \\ 0 & G_{LED}(\lambda) & 0 \\ 0 & 0 & B_{LED}(\lambda) \end{bmatrix} \begin{bmatrix} \overline{xmc}(\lambda) \\ \overline{ymc}(\lambda) \\ \overline{zmc}(\lambda) \end{bmatrix} - M \begin{bmatrix} r(\lambda) \\ g(\lambda) \\ b(\lambda) \end{bmatrix} - n d\lambda$$

wherein $r(\lambda)$, $g(\lambda)$ and $b(\lambda)$ are positive real continuous sensitivity functions of the selected RGB filter set wherein $\lambda \in \sigma = [380, 780]$ nm and wherein $R_{LED}(\lambda)$, $G_{LED}(\lambda)$ and $B_{LED}(\lambda)$ are the spectra of red, green and blue (RGB) LED light sources and wherein $\overline{xmc}(\lambda)$, $\overline{ymc}(\lambda)$, and $\overline{zmc}(\lambda)$ are a set of color matching functions and wherein M is a 3x3 constant matrix and n is a 3x1 constant vector.

4. (Original) The method of claim 3 further comprising:
constructing spectral approximation functions \hat{x} , \hat{y} , and \hat{z} for the RGB LED light sources from the M and n determined by evaluating the criteria function.

5. (Original) The method of claim 4 wherein the spectral approximation functions are represented by the equation:

$$\begin{bmatrix} \hat{x} \\ \hat{y} \\ \hat{z} \end{bmatrix} = (M \begin{bmatrix} r(\lambda) \\ g(\lambda) \\ b(\lambda) \end{bmatrix} + n) * u \{ M \begin{bmatrix} r(\lambda) \\ g(\lambda) \\ b(\lambda) \end{bmatrix} + n \}$$

and

wherein u is a step function.

6. (Original) The method of claim 5 further comprising:
determining estimated tristimulus values for the RGB LED light sources based upon the spectral approximation functions.

7. (Original) The method of claim 6 wherein the estimated tristimulus values \hat{X} , \hat{Y} , \hat{Z} are determined according to the relationship represented by the equation:

$$\begin{bmatrix} \hat{X} \\ \hat{Y} \\ \hat{Z} \end{bmatrix} = \int_{\sigma} \begin{bmatrix} \hat{x}(\lambda) \\ \hat{y}(\lambda) \\ \hat{z}(\lambda) \end{bmatrix} P(\lambda) d\lambda$$

wherein $P(\lambda) = R_{LED}(\lambda) + G_{LED}(\lambda) + B_{LED}(\lambda)$.

8. (Currently Amended) The method of claim 7 further comprising:
implementing a color sensing color calibration through the function
represented by the equation:

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = M_{cal} M_c^{-1} \begin{bmatrix} \hat{X} \\ \hat{Y} \\ \hat{Z} \end{bmatrix}$$

wherein X , Y and Z are tristimulus functions of the RGB LED ~~illuminants~~ light sources and wherein M_{cal} is a calibration matrix and wherein M_c^{-1} is an inverse MacAdam's matrix.

9. (Original) A computer readable medium storing a computer program comprising:

computer readable code for constructing a criteria function describing an error between desired color matching functions and a spectral response of an RGB filter set;

computer readable code for determining RGB filter set response characteristics based on the criteria function; and

computer readable code for determining color estimation parameters for substantially optimal color estimation with the RGB filter set based upon the determined RGB filter set response characteristics.

10. (Original) The computer readable medium of claim 9 wherein determining the RGB filter response characteristics comprises evaluating the criteria function to determine the RGB filter response characteristics resulting in a minimum value of a

constraint set criteria function.

11. (Original) The computer readable medium of claim 10 wherein the criteria function is represented by the equation:

$$J_{M,n} = \int_{\sigma} \begin{bmatrix} R_{LED}(\lambda) & 0 & 0 \\ 0 & G_{LED}(\lambda) & 0 \\ 0 & 0 & B_{LED}(\lambda) \end{bmatrix} \begin{bmatrix} \overline{xmc}(\lambda) \\ \overline{ymc}(\lambda) \\ \overline{zmc}(\lambda) \end{bmatrix} - M \begin{bmatrix} r(\lambda) \\ g(\lambda) \\ b(\lambda) \end{bmatrix} - n d\lambda$$

wherein $r(\lambda)$, $g(\lambda)$ and $b(\lambda)$ are positive real continuous sensitivity functions of the RGB filter set wherein $\lambda \in \sigma = [380, 780]$ nm and wherein $R_{LED}(\lambda)$, $G_{LED}(\lambda)$ and $B_{LED}(\lambda)$ are the spectra of red, green and blue LED light sources and wherein $\overline{xmc}(\lambda)$, $\overline{ymc}(\lambda)$, and $\overline{zmc}(\lambda)$ are a set of color matching functions and wherein M is a 3x3 constant matrix and n is a 3x1 constant vector.

12. (Original) The computer readable medium of claim 11 further comprising:
computer readable code for constructing spectral approximation functions \hat{x} , \hat{y} , and \hat{z} for the RGB LED light sources from the M and n determined by evaluating the criteria function for the RGB filter set.

13. (Original) The computer readable medium of claim 12 wherein the spectral approximation function equation is:

$$\begin{bmatrix} \hat{x} \\ \hat{y} \\ \hat{z} \end{bmatrix} = (M \begin{bmatrix} r(\lambda) \\ g(\lambda) \\ b(\lambda) \end{bmatrix} + n) * u\{M \begin{bmatrix} r(\lambda) \\ g(\lambda) \\ b(\lambda) \end{bmatrix} + n\}$$

wherein u is a step function.

14. (Original) The computer readable medium of claim 13 further comprising:
computer readable code for determining estimated tristimulus values for the RGB LED light sources based upon the spectral approximation functions.

15. (Original) The computer readable medium of claim 14 wherein the estimated tristimulus values \hat{X} , \hat{Y} , \hat{Z} are determined according to the relationship represented by the equation:

$$\begin{bmatrix} \hat{X} \\ \hat{Y} \\ \hat{Z} \end{bmatrix} = \int_{\sigma} \begin{bmatrix} \hat{x}(\lambda) \\ \hat{y}(\lambda) \\ \hat{z}(\lambda) \end{bmatrix} P(\lambda) d\lambda$$

wherein $P(\lambda) = R_{LED}(\lambda) + G_{LED}(\lambda) + B_{LED}(\lambda)$.

16. (Currently Amended) The computer readable medium of claim 15 further comprising:

computer readable code for implementing a color sensing color calibration through the function represented by the equation:

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = M_{cal} M_c^{-1} \begin{bmatrix} \hat{X} \\ \hat{Y} \\ \hat{Z} \end{bmatrix}$$

wherein X , Y and Z are tristimulus functions of the RGB LED illuminants-light sources and wherein M_{cal} is a calibration matrix and wherein M_c^{-1} is an inverse MacAdam's matrix.

17. (Currently Amended) A system for determining RGB filter set and color estimation performance for RGB LED color sensing comprising:

a storage device for storing data describing spectral responses of a plurality of RGB filter sets;

a user interface for receiving a user selection of one of the RGB filter sets;

means for constructing a processor configured: to construct a criteria function describing an error between desired color matching functions and [[a]] the spectral response of [[an]] the selected RGB filter set; means for determining to determine RGB filter set response characteristics for the selected RGB filter set based on the criteria function; and means for determining to determine color estimation

parameters for substantially optimal color estimation with the selected RGB filter set based upon the determined ~~RGB filter set response characteristics~~ for the selected RGB filter set.

18. (Currently Amended) The system of claim ~~[[17]]~~ 21 further comprising:
~~means for constructing wherein the processor is configured to construct~~
spectral approximation functions \hat{x} , \hat{y} , and \hat{z} for the RGB LED light sources from the M and n determined by evaluating the criteria function.

19. (Canceled)

20. (Currently Amended) The system of claim ~~[[19]]~~ 18 further comprising:
means for implementing a color sensing color calibration through the function represented by the equation:

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = M_{cal} M_c^{-1} \begin{bmatrix} \hat{X} \\ \hat{Y} \\ \hat{Z} \end{bmatrix}$$

wherein X , Y and Z are tristimulus functions of the RGB LED illuminants ~~light sources~~ sources and wherein M_{cal} is a calibration matrix and wherein M_c^{-1} is an inverse MacAdam's matrix.

21. (New) The system of claim 17, wherein the criteria function is represented by the equation:

$$J_{M,n} = \int_{\sigma} \begin{bmatrix} R_{LED}(\lambda) & 0 & 0 \\ 0 & G_{LED}(\lambda) & 0 \\ 0 & 0 & B_{LED}(\lambda) \end{bmatrix} \begin{bmatrix} \overline{xmc}(\lambda) \\ \overline{ymc}(\lambda) \\ \overline{zmc}(\lambda) \end{bmatrix} - M \begin{bmatrix} r(\lambda) \\ g(\lambda) \\ b(\lambda) \end{bmatrix} - nd\lambda$$

wherein $r(\lambda)$, $g(\lambda)$ and $b(\lambda)$ are positive real continuous sensitivity functions of the selected RGB filter set wherein $\lambda \in \sigma = [380, 780]$ nm and wherein $R_{LED}(\lambda)$, $G_{LED}(\lambda)$ and $B_{LED}(\lambda)$ are the spectra of red, green and blue (RGB) LED light sources and

wherein $\overline{xmc}(\lambda)$, $\overline{ymc}(\lambda)$, and $\overline{zmc}(\lambda)$ are a set of color matching functions and wherein M is a 3x3 constant matrix and n is a 3x1 constant vector.